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Interactive
comment

Interactive comment on "Space Weather Forecasting: What We Know Now and What Are the Current and Future Challenges?" *by Bruce T. Tsurutani et al.*

Anonymous Referee #2

Received and published: 2 September 2019

[Main comments]

In this review paper, the authors summarized observations of space weather phenomena and their physical interpretations. The main topic is about geomagnetic storms and magnetospheric phenomena, which is based on the authors' previous studies, ranging from the arrival of ICMEs and solar wind plasma at the Earth to the resulting geomagnetic and ionospheric storms. Phenomenological understanding is broadly explained, and questions about unresolved problems are described in each section, leading to what to reveal by new space missions like PSP, Solar Orbiter, MMS, Arase and SWARM.

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Discussion paper

This paper is written not only for space plasma physicists but for non-space plasma readers, like solar physicists and ionospheric scientists. It looks that the authors hope lots of people to read this article and try the unresolved problems with the interdisciplinary cooperation. The terminologies are summarized at the end of the main text, and in each section, histories of the studies are explained, which are useful for beginners and young researchers.

On the other hand, though the title is "Space Weather Forecasting", the manuscript does not cover predictions of solar flares, CMEs, SEPs, GICs and plasma bubbles, as well as social impacts on the infrastructures. The methods using numerical simulations and machine-learning techniques are not well introduced in this paper. It would be more useful for readers if the authors can include the current prediction models and their prediction accuracy in this review paper.

Especially, with a new approach using machine-learning algorithms, probabilistic predictions can be done even if the physical mechanisms are not fully revealed. For accurate forecasting, the full understanding of physical processes are really necessary? If we understand all the nonlinear processes in space weather phenomena, can we forecast them perfectly? It would be also useful for readers if the authors can answer these questions.

[Minor comments]

1) [Fig. 7] It looks that the solar image is not from SDO but Yohkoh. SDO does not have a soft X-ray telescope.

2) [Fig. 8] The inner solar image was not taken by a soft X-ray telescope but an EUV telescope of EIT (195A Fe XII). The inner coronal image in the black circle was taken by Mauna Loa coronagraph, while the outer one was by SOHO/LASCO-C2.

3) [section 2.4.1] There is a sentence that to determine IMF-Bz component in the sheaths, we need more effort on predicting the slow solar wind plasma and magnetic

field, but this statement is obscure. What will be the key to predict the slow solar wind plasma?

4) [General comments] There are so many abbreviations like MC, ICME, IMF, CIR, HSS, HCS, HPS, HILDCAA, AE, EIA, EMIC wave, PC wave, RED, PPEF, SSW, SSS, which are difficult for non-space plasma readers to understand.

5) It's better to show the definition of L value.

Interactive comment on Nonlin. Processes Geophys. Discuss., https://doi.org/10.5194/npg-2019-38, 2019.